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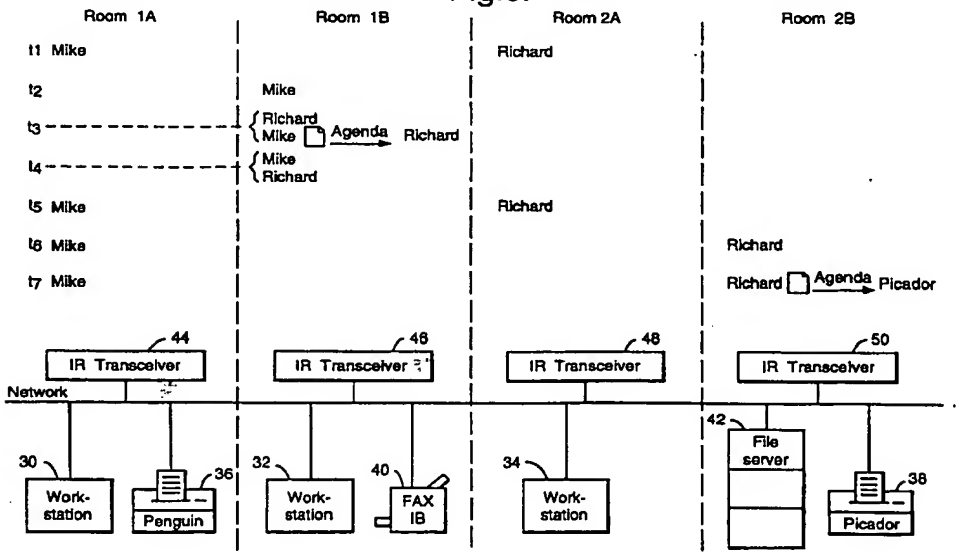
(54) System for accessing and distributing electronic documents

(57) A system including any number workstations, file servers, printers and other fixed devices coupled in a network, and a number of portable devices carried by users and coupled to the network by infrared (IR) link. Each portable device emulates its user's personal satchel for documents: the device is programmed to receive transmit and store document references or tokens, each of which is associated with an electronic document stored in the database. Documents are distributed from one person to another by transmission of document references or tokens, and a document is sent to a printer by beaming that document's reference or token to an IR transceiver associated with that printer. The portable device is preferably a handheld or wristwatch computer with a graphical display for enabling the user to transfer documents, and the fixed devices preferably include a scanner/copier/printer having its own IR transceiver.

Fig.3.



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Description

This invention relates generally to data access and distribution, and more particularly to a system for transferring electronic documents between portable computer devices, and between such devices and various forms of office equipment.

Electronic documents play an increasing role in our lives. Indeed nowadays many, if not most, documents ar created electronically; and we take it for granted that electronic documents are easier to store, retrieve, copy, print, update and distribute than paper documents.

For desk-bound, document-intensive workers this may indeed be the situation, but for people whose jobs require them to be more mobile, existing technology does not greatly assist in such tasks. For a mobile worker, electronic documents are significantly less convenient to *locate, read and distribute,* and yet these activities appear to be the dominant document-intensive activities outside the office. When away from his office or workstation (e.g., for a meeting), a worker is rarely able to access all or most of his electronic documents, and he will often resort to carrying a bulky set of paper documents as a precaution, even though they may not in fact be needed for the meeting.

There are many situations in which a paper document is clearly the most effective medium for exchanging information. Sometimes the intended recipient has no immediate need for the information, but they see a potential need for it in the future. In this situation it seems preferable to exchange the document electronically. Nevertheless they are forced to carry the document back to their office or home (perhaps having first stopped off at a copier or printer to obtain it), and contribute to their stack of paper documents.

Although many documents are created electronically, a relatively small proportion is distributed in that way. For example, if a person (the sender) wants to give an electronic document to someone (the recipient) they are currently talking to, the process essentially requires that the sender must break off the conversation, go to a workstation, and search for the document they wish to hand over; find out the recipient's electronic address; check how best to encode the data for the recipient's machine; and then transfer the document. Compared with simply handing over a paper document this process is disruptive, time-consuming and unreliable. Furthermore, rarely can the sender or the recipient immediately confirm that the document has been successfully transferred between them. To do so requires the recipient to go to his workstation, search for the document and explicitly acknowledge to the sender that the document was received.

Another problem arises even when a person decides to hand over a paper copy to the recipient. If he doesn't have a paper copy to hand, to avoid disruption he will often promise to print the document later and hand it over after the meeting has concluded, a task he may simply forget to do. If it is decided to print out the document there and then, the person must break off from the conversation, find the electronic document, find a printer that isn't in use, send the document to the printer, and then *remember* to go and pick it up when printing is complete. However, people often forget to pick up their output; and if a confidential document has been printed on a shared (network) printer, the sender must ensure that he is on hand to collect it immediately.

A further problem exists for workers who are unable to gain access to their workstation or network: it is now commonplace for members of a committee to travel long distances to attend important meetings. For example, standards committees convene experts from all over the world; and participants try to arrive prepared with all the information they might need to present to their colleagues, respond to questions, or take decisions. Often the committee meets at one of several different locations each time: the European Parliament, for example, regularly moves between Brussels, Luxembourg and Strasbourg. It may be impossible for the attendees to anticipate the document needs, or they may not be able to afford to carry printed versions of everything. When a missing document is needed urgently, the situation can be remedied by a telephone call back to the office to someone who has access to the electronic document and can print it out or fax it to the meeting. At best this disrupts the flow of the meeting, and there is a risk that the document will not be received at all.

It is known to use infrared (IR) communication to transfer electronic documents from one portable computer to another during a meeting - e.g. the Apple® Newton. However, compared with existing electronic communications devices, the (IR) data transfer rate between such machines is very slow: to beam a simple electronic document from one to another, users may need to stand within a few feet of each other and point the IR transmitters of their machines at each other for several minutes.

A further problem is that it is not possible to store large numbers of electronic documents on a portable, hand-held or wristwatch computer. This is the case with documents in, e.g., PostScript, but may be an even greater problem with scanned (bitmapped) documents.

The present invention provides a system for accessing or distributing electronic documents, including: a database of electronic documents and corresponding document references, and a plurality of objects, at least one of said objects preferably being portable or mobile, each object including means for communicating with the or ach other object and with a user interface, and means for receiving, storing or transmitting a document reference corresponding to one of said electronic documents.

The present invention further provides a portable device for accessing or distributing electronic documents, including: means for communicating with fixed or mobile electronic devices and with a user interface, at least one of said devices including a database of electronic documents and corresponding document references, and means for receiving, storing or transmitting a document reference corresponding to one of said electronic documents.

The present invention furth r provides an apparatus for scanning, copying and/or printing documents, including: means for accessing a database electronic documents, each electronic document having a corresponding document reference, means for communicating with one or more of a plurality of objects, at least one of said objects preferably being portable or mobile, and with a user interface, and means for receiving, storing or transmitting a document reference corresponding to one of said electronic documents.

Each document reference corresponds to a single electronic document, and a document may have any number (e.g., originating from different users) of corresponding document references. For a very small electronic document, the document reference may include the electronic document itself. However, as an example, the document reference suitably comprises a universal resource locator (URL) as defined in the Worldwide Web Information system (see Berners-Lee T.J., Cailliau R., & Groff J.-F., *The Worldwide Web, Computer Networks and ISDN Systems* 25 (1992), pp. 454-459. North-Holland; and Mangers J.J, *World-Wide Web, Mosaic and More* (1995), MGraw-Hill, London).

Each electronic document or document reference has a corresponding user interface (UI) representation. The UI representation of the electronic document may comprise in particular an icon or text on a graphical display, a sound, any combination of these, or, boadly, any real or ephemeral object capable of being selected by means of the user interface. The UI command language may be text- or menu-based, or natural language or direct interaction (as in the embodiment described herein), or may use any other suitable method (see Preece J., *Human Computer Interaction* (1994). Addison Wesley).

Alternatively, according to the invention, the or each document reference for an electronic document may be invalidated or even absent (e.g. through deletion): the electronic document remains in the database, but remote access to it using document references/document satchel technology described herein is precluded.

The invention is particularly advantageous in that document references take up a comparatively small amount of storage space in memory, and their transmission from one (fixed or mobile) device to another may be accomplished very quickly.

The invention is advantageous, for example, for the worker who visits numerous sites where documents are to be given to him: instead of collecting a bundle of papers, he collects a string of documenst references in his portable device.

The present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a view of the portable device according to one embodiment of the invention;
Figure 2 shows diagramatically the user interface and icons employed in one embodiment of the invention (a) for a user's workstation, and (b) for the user's portable device;
Figure 3 is a schematic illustration of an embodiment of the networked system according to the invention;
Figure 4 shows successive displays on the portable device of each user corresponding to the sequence in Fig. 3;
Figure 5 is a flow chart of the process (a) carried out in a portable device in exchanging a document token, (b) carried out in a portable device in updating the display thereof, and (c) carried out in a fixed object such as a printer or multifunction machine when a nearby user prints out a document; and
Figure 6 shows schematic representations of various procedures for distributing documents which are may be performed using the present invention.

The present invention is based upon PARCTab technology; and the system hardware is described in detail in: (1) Adams N., Gold R., Schilit B.N., Tso M. & Want R., (1993), An Infrared Network for Mobile Computers, in *Proc. USENIX Symposium on Mobile & Location-independent Computing*, pp. 41-52, Cambridge, MA:USENIX; and (2) Schilit B.N., Adams N., Gold R., Tso M., Want R., (1993), The PARCTab Mobile Computing System, in *Proc. 4th Workshop on Workstation Operating Systems (WWOS-IV)*, pp.34-39, Napa, CA:IEEE.

The Tab is a form of personal digital assistant (PDA) - a small lightweight portable computer that can be attached to the belt, or carried in a handbag. In the following, the invention is described in particular in relation to the use of such Tabs; however, it will be appreciated that any suitable form of portable computer may be used, and the computer may take the form, for example and subject to design constraints, of a conventional wristwatch. An exemplary system, for transferring data such as document references to and from a wristwatch computer, is disclosed in British patent application No. 9425184.0.

As can be seen in Fig. 1, the Tab 2 is equipped with a small bitmap screen 4 which is touch sensitive, enabling user inputs by means of finger tip or pointer 6. The Tab is also provided with 19.2 Kb/s bi-directional IR communications facilities (diode transmitter/receiver) 8, and three buttons 10. It will be appreciated that the wireless communication may alternatively be implemented by means of suitable radio technology well known in the art (see, e.g., Weiser M., The Computer for the 21st Century, *Scientific American*, September 1991, pp. 66-75). As a further alternative, any of the

communications links referred to in the present disclosure which are provide by IR links may, where appropriate, be implemented by wired links. The Tab further includes a tone generator 12 for use, for example, in giving audible signals to the user. Within a building, users can carry their Tabs 2 from room to room while moving into and out of contact, or maintaining contact, with a network of stationary servers which provide a wide variety of services. As part of the Tab user interface, various icons 14 are displayed on the screen 4 to provide to the user access to such services, as is well known in the art (see Smith et al., Designing the Star User Interface, *Byte* 7(4) (1982), pp. 242-282).

The invention is implemented by employing a user interface (for example, on each Tab, and elsewhere) whereby the Tab emulates a document satchel. The notion of a satchel is that of a portable holder of documents, enabling transport of the documents to a remote location for later use, distribution, etc. Although in the following an electronic document will be said to be stored in a satchel, a feature of the present invention is that it is an document reference, which identifies the electronic document, which is received by, stored on, and transmitted by the Tab. In the following description, the document reference takes the form of an electronic token which uniquely corresponds to a document. The documents themselves may be stored on a file server, or on the user's personal workstation, on the network. In some cases the token may contain the document, e.g. when the document is very tiny. A typical database of stored documents and respective tokens is illustrated in Table 1. The tokens are shown as 8-bit codes for the purpose of illustration only; and it will be appreciated that the tokens may have any suitable format to suit a desired application.

Document	Token
5000 Series machine specifications	01011010
5045 Maintenance Manual	01101001
Agenda	00101011
...	...
ODP sales pie charts	00010111
5053 Production schedule	01011110

Table 1: Typical documents and tokens in a database.

In any event, the token contains sufficient information for the system to locate the relevant document, as in the case of the above-mentioned URLs. A URL (uniform resource locator) is essentially a way for the World-Wide Webto specify where a particular resouce (e.g. document) is located on the Internet, while at the same time describing the tool that is required to access it and specifying the actual file's location on a particular internet host. The situation whereby files on a local machine may be embedded with subdirectories and may exists on different physical disk drives is true the Web also, except that all of this applies to a particular machine on the internet, of which there are hundreds of thousands. Since each machine's file locations differ widely, URLs are used to identify where they reside. In general URLs take the form:

http://www.ncsa.uiuc.edu/Mosaic/Demo/demo.html

Many resouce types are now available, including in particular ftp: for a FTP (File Transfer Protocol) server - the main method of moving files around on the internet. URLs allow a document to link with other services and documents on the internet.

As an alternative, the user interface may be fully or partially omitted from the PDAs, the PDAs in that case being designed, e.g., to reproduce a suitable user interface when in the vicinity of, and in communication with, a suitable device (e.g., workstation, printer, copier, fax machine, etc) having its own display. In such a case, the PDA may be programmed to emit a 'beep' from its tone generator to indicate transmission and/or receipt of a document; although here the person who has had an electronic 'document' sent to his PDA is unable immediately to determine what the document is.

Figure 2 shows diagramatically the user interface and icons employed in one embodiment of the invention (a) on the display of a user's workstation, and (b) on the display the user's portable device, so as to represent the contents of his satchel. It will be appreciated by a person skilled in the art that any user interface, icons and/or process for transferring documents from the electronic desktop over the IR link may be employed.

Electronic documents may placed into the user's satchel using his personal workstation, e.g. a Macintosh. Satchel owners have on their electronic desktop (Fig. 2(a)) a special small folder icon 16 called the Satchel folder, and this preferably has a special icon to distinguish it from other folders on the desktop. The satchel folder behaves just like any

other folder, and the open Satchel window is shown at 18, including the user's name and a list of items in the satchel. An exception compared with other folders is that any document 20 dragged into the folder 18 by a user (e.g. using a conventional mouse to move a pointer 19) automatically initiates a data transfer operation (between the workstation and the user's Tab, e.g. by means of IR communication as discussed above) which results in the icon 22 of the document appearing in the satchel display 24 on the Tab. The information transmitted over the IR link includes the icon type, document name, and the corresponding token, the token being stored in the satchel's (Tab's) memory. It will be appreciated that such a data transfer operation may be accomplished in many other ways, e.g. by simply typing in a command on a keyboard. In one embodiment, a reference to a whole folder, filesystem or network of URLs may be transferred.

The satchel's user interface is implemented in such a way that the satchel contents are displayed on the screen (Fig. 2(b)) as a series of one line entries, each line corresponding to a document token and including a small icon and the name of the document. Down the right hand edge of the display is a scroll bar 26 enabling a user to scroll up or down by pressing (e.g. a pen) on the appropriate arrow 28 of the scroll bar, until the desired entry is found.

In a similar manner, any document appearing on the Tab satchel screen 24 automatically appears in the satchel folder 18 on the the user's desktop, provided the Tab has been within range of an IR transceiver coupled to his workstation, so as to enable the relevant satchel contents data to be downloaded to the workstation. From there, documents in the satchel folder can be opened and edited *in situ*, or they can be dragged out of the the satchel folder and onto the desktop.

Because the satchel (Tab) uses an IR wireless communications system it is easy to discover which other IR-linked devices are within its line of sight. The PARCtab network disclosed in the above-mentioned references (1) & (2) includes IR gateways, one per room, that provide the satchels with a link to the cable network services upon which they rely. However, any suitable location technique can be used to determine where the satchel is. Consequently, each satchel is context-sensitive: each one knows which room it is in at any instant, and which other satchels or IR-linked devices (e.g. printers) are there with it.

Each satchel (Tab) presents this context information to the user, and it takes the form of additional entries on the satchel screen. These entries are not input by the user, but pop up automatically as the user moves around the building carrying his satchel. So, for example, when Mike meets Richard, an entry representing Richard appears in Mike's satchel, and a corresponding entry representing Mike appears on Richard's. Similarly, when Mike is in the same room as a printer, an entry (icon 25 + name) showing the name of the printer appears in his satchel (see Fig. 2(b)). These pop-up entries provide a streamlined way for users to pass documents to eachother, or to exchange them with nearby devices.

Referring to Fig. 3, there is shown schematically a networked system for implementing the present invention, and a sequential procedure by which a document is distributed using document satchels. Connected on a conventional network (e.g. ethernet) are a number of electronic devices, such as workstations 30, 32, 34, printers, 36, 38, fax machine 40, and file server 42, these devices being referred to generally as "objects". For the purpose of illustration, that part of the network connecting four rooms is shown; and, for example, rooms 1A, 1B may be in a first building, while rooms 2A, 2B may be in a second building, remote from the first.

In each room 1A-2B at least one IR transceiver 44,46,48,50 is used to provide communication between any Tabs present in the room and the network (see the above-mentioned Schilit *et al.* references). Alternatively, any of the objects 30-42 may be provided with its own IR transceiver for communication with Tabs. Consequently, room 1A contains workstation 30, printer 36 and transceiver 44; room 2B contains file server 42, printer 38 and transceiver 50, and so on.

In Fig. 3, the document distribution process is illustrated by showing the positions of the Tabs of two people, Mike and Richard, and the operations which are performed, at intervals before and after their meeting in one of the rooms. The displays on Mike and Richard's Tabs at the instants t_1-t_7 during the process of Fig. 3 are shown in Fig. 4.

At time t_1, Mike is in room 1A (his office) and Richard is in room 2a. As shown in Fig. 4, Mikes satchel contains the (icon for the) document "Agenda" (and therefore has its token stored in its memory), and the icon for his printer (called "Penguin") 36, which appears automatically since printer 36 is located in room 1A. Next, at time t_2, Mike and Richard meet in room 1B: the icon for the Penguin printer has automatically disappeared from his satchel display; and the icon for Richard's satchel appears in Mike's satchel, and the icon for Mike's satchel appears in Richard's satchel. In addition, the icon for the fax machine 40 automatically appears in both satchels.

At time t_3, Mike decides to pass a copy of the electronic document "Agenda" to Richard. (If, say, Mike does not have the document he wants to pass on in his satchel, he may employ a memory aid and information retrieval system provided on his Tab, as disclosed in published European patent application EP-A-637,807, corresponding to U.S. application S.N. 08/279,961, in order to locate the document he wants and retrieve it's token.) To pass a copy of the electronic document "Agenda" to Richard, Mike simply selects the document icon on the touch screen of his tab using a pen or the like, and copies the icon onto Richard's satchel icon. This initiates a process wherein the digital token (see Table 1) for "Agenda" is beamed over the IR link from Mike's Tab to Richard's Tab. (The time taken for this will depend on the communication protocol used, the use of security encryption, and the size of the token, but in any event is likely to be a very small fraction of the time which would be needed to transfer the entire document via the same link, and typically the time taken will be a fraction of a second.) Thus the token for "Agenda" is stored on Richard's Tab for later distribution or use. When this operation is completed (t_4), the icon for "Agenda" also appears on the screen of Richard's Tab: it is now in his personal satchel.

Next (t_5), Mike returns to room 1A and his satchel display reverts to that existing at t_1, which is described above. At the same time (say), Richard returns to room 2A: the icons for Mike's satchel and Fax 1B have automatically disappeared from his Tab screen, so that the only item left in his satchel is the document "Agenda" (Fig. 4). Richard now decides that he would like to print out "Agenda", but doesn't have a printer in his office. At t_6, therefore, he walks into room 2B in the same building which houses the printer 38 called "Picador". The icon for Picador automatically appears as an entry on Richard's Tab screen as a result of the IR communication and object sensing procedure discussed above.

To print out "Agenda", Richard, at time t_7, simply moves (using a pen to move the pointer on his touch screen) a copy of the icon for "Agenda" onto the Picador icon. As a result, an IR signal is beamed from Richard's Tab to the transceiver 50, or to Picador's own IR transceiver, the signal including the digital token for "Agenda". Using the token, the electronic document "Agenda" is fetched from the database in which is stored (e.g. file server 42; but it may be from any location on the network), or is accessed from Mike's workstation 30, and then printed out on Picador. In one embodiment, Picador may be a "confidential" printer, in which case the document is not printed straight away, but the print operation is deferred. Then, the next time Richard is in the vicinity of Picador, Richard's TAB and Picador sense this (via IR communication); the print operation is commenced by Picador; and Richard's TAB emits an audible 'beep' to tell him to collect the freshly printed document immediately upon printing.

In an alternative embodiment, Richard may submit the document "Agenda" for a third party service (e.g. OCR, summarising, and/or translation service) available on the network; and suitably this is achieved by dragging and dropping the icon for "Agenda" onto a corresponding icon for that service on the TAB screen.

Figure 5 shows a flow chart of the processing carried out in each Tab during an encounter with another Tab or IR-linked object. In step S1 the Tab broadcasts, or initiates the broadcast of, the tab user's identity code to the environment. (This code may be encrypted using shared key technology which is known in the art.) Next, at step S2, the software checks for a legal (valid) user input (in this example, the user copying a document icon to another satchel, or other object, using the touchscreen). If such a legal input is made, the document token is transmitted by IR to the recipient at step S3, and the processing returns to step S1. (The token transmission may include encryption using shared key technology which is known in the art, i.e. anything which has been encrypted with a user's private key can only be decrypted using the public key corresponding to that private key.)

If no such legal input is entered, the software checks at step S4 to see whether any IR signal (e.g. satchel or printer ID, or document token) has been received. If none has been received the processing returns to step S1.

If an IR signal has been received, the software then checks (step S5) to see whether it is an ID (e.g., another satchel). If so, then the received ID is displayed on the tab screen, at step S6, i.e. satchel icon + that satchel user's name. (Again this ID code may need to be decrypted using shared key technology which is known in the art.). The processing then returns to step S1.

If the signal is not an ID, then the software next checks at step S7 whether the received IR signal is a document token. If not, then there is a system error, and this is indicated on the Tab screen. If the received IR signal is a document token, then the document corresponding to the token (i.e. icon + document name) are displayed (step S8) on the tab screen. (Again this ID code may need to be decrypted using shared key technology which is known in the art.). The processing then returns to step S1.

Figure 5(b) is a schematic flow chart of the process carried out in a portable device, in one embodiment of the invention, in updating the display thereof. Figure 5(c) is a schematic flow chart of the process carried out in a fixed object such as a printer or multifunction machine, in one embodiment of the invention, when a nearby user prints out a document.

Figure 6 shows schematic representations of various procedures for distributing documents which may be performed using the present invention. In Fig. 6, item 60 is a multifunction machine equipped with IR communication facilities for wirelessly communicating with tabs, base stations in rooms, and any of the other objects mentioned above which are within range of its IR transmitter at a given time, the machine 60 also being hooked up to the network (see Fig. 3) so as to facilitate rapid transfer of electronic documents between itself and any number of other similar machines 60 or other objects on the network. The machine 60 may for example provide any combination of the functions of scanning, copying, faxing and printing, as is known in the art.

As can be seen in Fig. 6(a), document A is initially scanned by the multifunction machine 60 and its corresponding token is beamed by IR to Ann's Tab, and the relevant icon entry appears in her satchel. Some time later (e.g. when document A is not available), Ann beams the token to the machine 60 (by means of the icon-dragging process described above in relation to Figs 3 and 4, and the machine automatically prints out document A.

In Fig. 6(b), the document A has been created on a user's conventional workstation 62. The user then sends the electronic document to the multifunction machine 60, which then beams by IR the corresponding token to Ann's Tab.

Referring to Fig. 6(c), here two multifunction machines 60, 60' are coupled on a network. Initially document A is scanned in on machine 60 which beams the token to Ann's tab, as in Fig. 6(a). Some time later and, for example at a remote location, Ann decides she wants a hard copy of document A. She simply beams the token to nearby machine 60' (as described with reference to Fig. 6(a)); machine 60' thereupon retrieves the electronic document A over the network from machine 60 or an associated file server (not shown), and then prints out the document.

The distribution and printing of a document (A) is again illustrated in Fig. 6(d). The process is the same as in Fig. 6 (c), except that the token is beamed from Ann to Bob for the latter to print out the document A on the second machine 60'. In an alternative embodiment, the token for document A may be characterised such that A nn is able to receive and transmit it, but not to obtain access to the document itself, e.g. by printing. In this way, Ann is able to 'trade' in a document which is inaccessable to her: she can thus act as a courier for confidential documents.

In Fig. 6(e), the case where the Tab owner is not in the vicinity of a multifunction machine is illustrated: here the machine is linked to a fax machine 66 over the telephone network 64. The document A has been scanned in and stored electronically in a database by machine 60. Later, Ann is at a location where she needs a hard copy of document A and has access to fax machine 66. Using the fax machine she dials up the multifunction machine 60 and, upon gaining access, she operates her Tab to transmit a tone signal down the telephone representing the token for document A and commanding the machine 60 to transmit document A to the fax machine 66. The machine promptly accesses the electronic document A and sends it down the telephone line to the fax machine 66 where it is printed out.

The same operation is illustrated in Fig. 6(f), with the exception that in this case the fax machine 66' is equipped with its own IR transceiver 68, enabling the token for document A'to be beamed by IR from Ann's Tab to the transceiver 68 and then electronically conveyed from the fax machine 66' to the multifunction machine 60.

The embodiment illustrated in Fig. 6(g) makes use of radiopaging technology. Bob is equipped with a radiopager, or a Tab which emulates a radiopager, and while away from his office contacts Ann to let her know that he requires a copy of document A. Ann scans in document A in the multifunction machine 60, and then commands the machine to transmit the token for document A over the pager network 70 to Bob's pager (Tab). Bob is then able to go to any printer, fax, etc adapted to receive such tokens, and to print out a copy of document A.

Numerous futher embodiments will be apparent to persons skilled in the art. For example, the satchel may be implemented using a (GSM) portable telephone coupled to a PCMCIA cellular data card which can be plugged into a palmtop or notebook computer. Alternatively, the satchel functionality may be incorporated into a pager or mobile phone.

Claims

1. A system for accessing or distributing electronic documents, including: a database of electronic documents and corresponding document references, and a plurality of objects, at least one of said objects preferably being portable or mobile, each object including means for communicating with the or each other object and with a user interface, and means for receiving, storing or transmitting a document reference corresponding to one of said electronic documents.

2. A portable device for accessing or distributing electronic documents, including: means for communicating with fixed or mobile electronic devices and with a user interface, at least one of said devices including a database of electronic documents and corresponding document references, and means for receiving, storing or transmitting a document reference corresponding to one of said electronic documents.

3. The device according to claim 2, wherein said user interface is integral with the device.

4. The device according to claim 2 or 3, further including means for displaying a representation of the or each document whose reference is stored in the device.

5. An apparatus for scanning, copying and/or printing documents, including: means for accessing a database of electronic documents, each electronic document having a corresponding document reference, means for communicating with one or more of a plurality of objects, at least one of said objects preferably being portable or mobile, and with a user interface, and means for receiving, storing or transmitting a document reference corresponding to one of said electronic documents.

6. The system, device or apparatus of any of the preceding claims, wherein the means for communicating includes an infrared transceiver.

7. The system, device or apparatus of any of the preceding claims, further including means for determining whether one or more other objects in located in the vicinity thereof.

8. The system, device or apparatus of claim 7, wherein the determining means includes means for identifying the or each object found to b in the vicinity thereof.

9. The system, device or apparatus of claim 8, further including means for displaying a representation f the or each object found to be in the vicinity thereof.

10. The device of claim 9 when dependent on claim 4, wherein said user interface is adapted to highlight the representation of one of said documents upon its selection by a user, and the device further includes means for initiating transmission of the document reference corresponding to said one document to another object upon the user copying the representation of said document onto the representation of said object.

Fig.1.

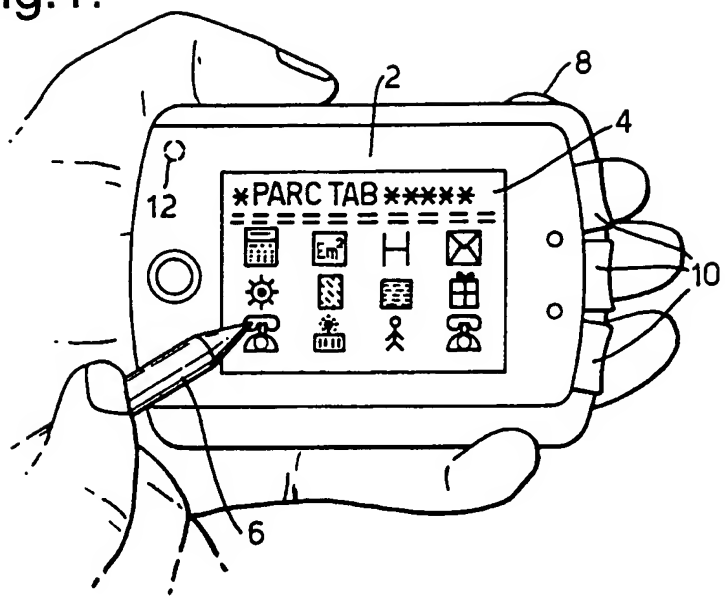


Fig.2(a).

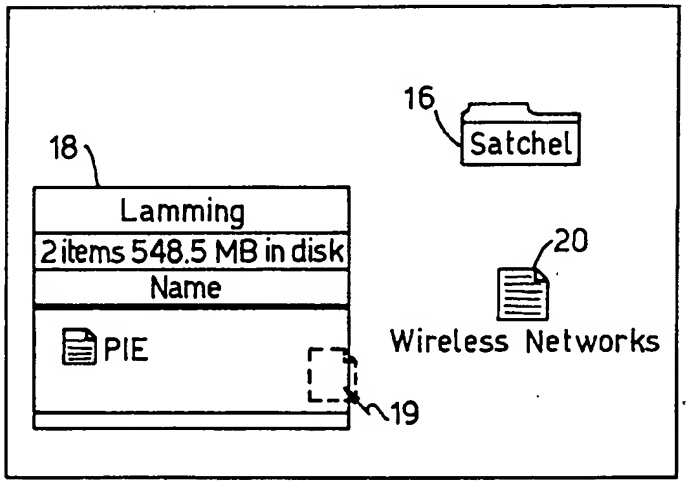


Fig.2(b).

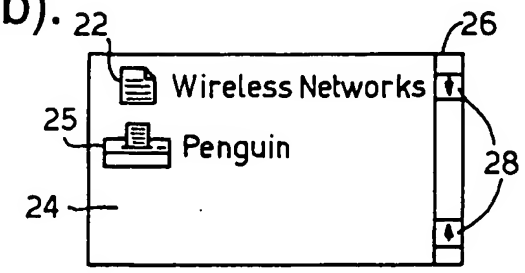


Fig.3.

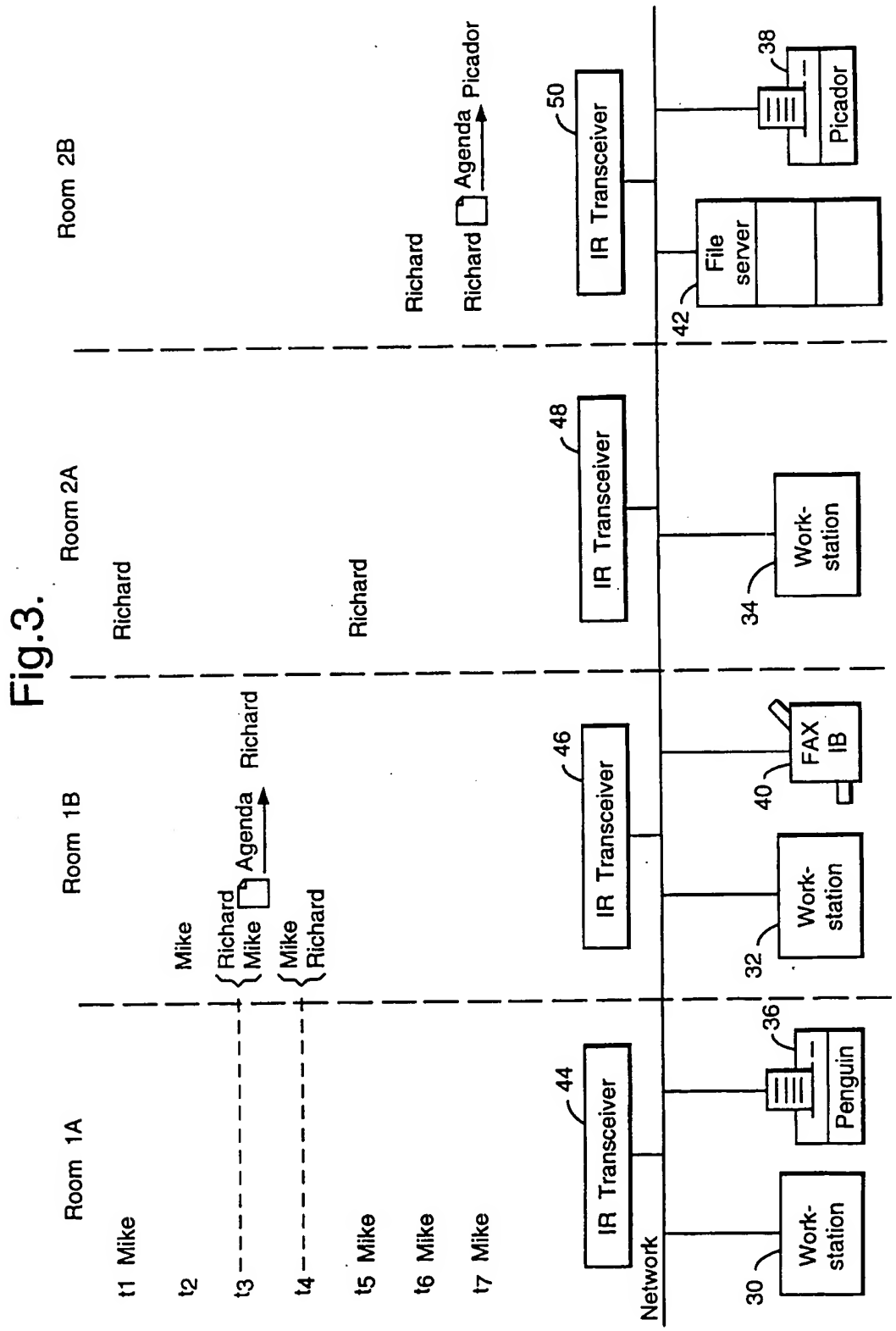

Room 1A
Room 1B
Room 2A
Room 2B
t1 Mike
t2
t3
t4
t5 Mike
t6 Mike
t7 Mike
Mike
Richard
Mike
Agenda
Richard
Mike
Richard
Richard
Richard
Richard
Agenda
Picador
Network
IR Transceiver
44
IR Transceiver
46
IR Transceiver
48
IR Transceiver
50
Work-station
30
Work-station
32
Work-station
34
Penguin
36
FAX IB
40
File server
42
Picador
38

Fig.4.

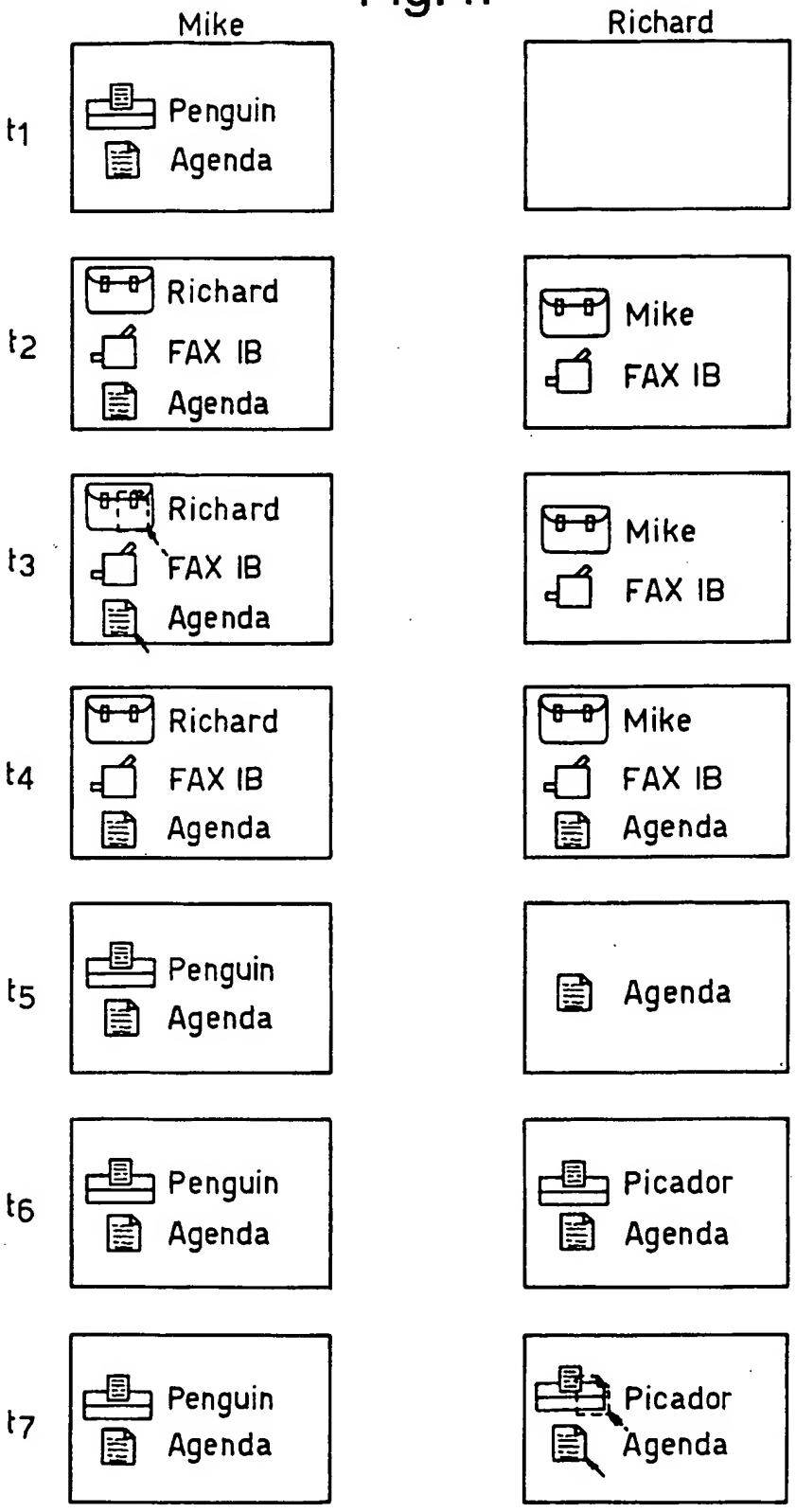
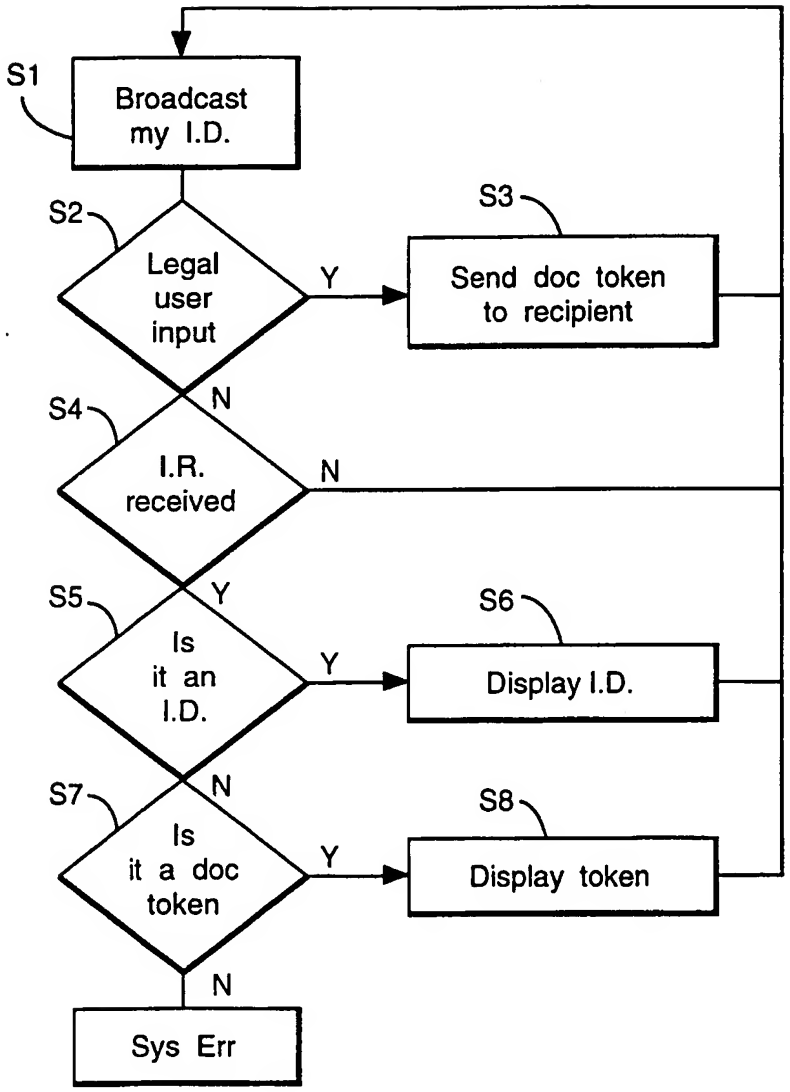

Mike
Richard
t1
Penguin
Agenda
t2
Richard
FAX IB
Agenda
Mike
FAX IB
t3
Richard
FAX IB
Agenda
Mike
FAX IB
t4
Richard
FAX IB
Agenda
Mike
FAX IB
Agenda
t5
Penguin
Agenda
Agenda
t6
Penguin
Agenda
Picador
Agenda
t7
Penguin
Agenda
Picador
Agenda

Fig.5(a).


S1
Broadcast my I.D.
S2
Legal user input
Y
S3
Send doc token to recipient
N
S4
I.R. received
N
Y
S5
Is it an I.D.
Y
S6
Display I.D.
N
S7
Is it a doc token
Y
S8
Display token
N
Sys Err

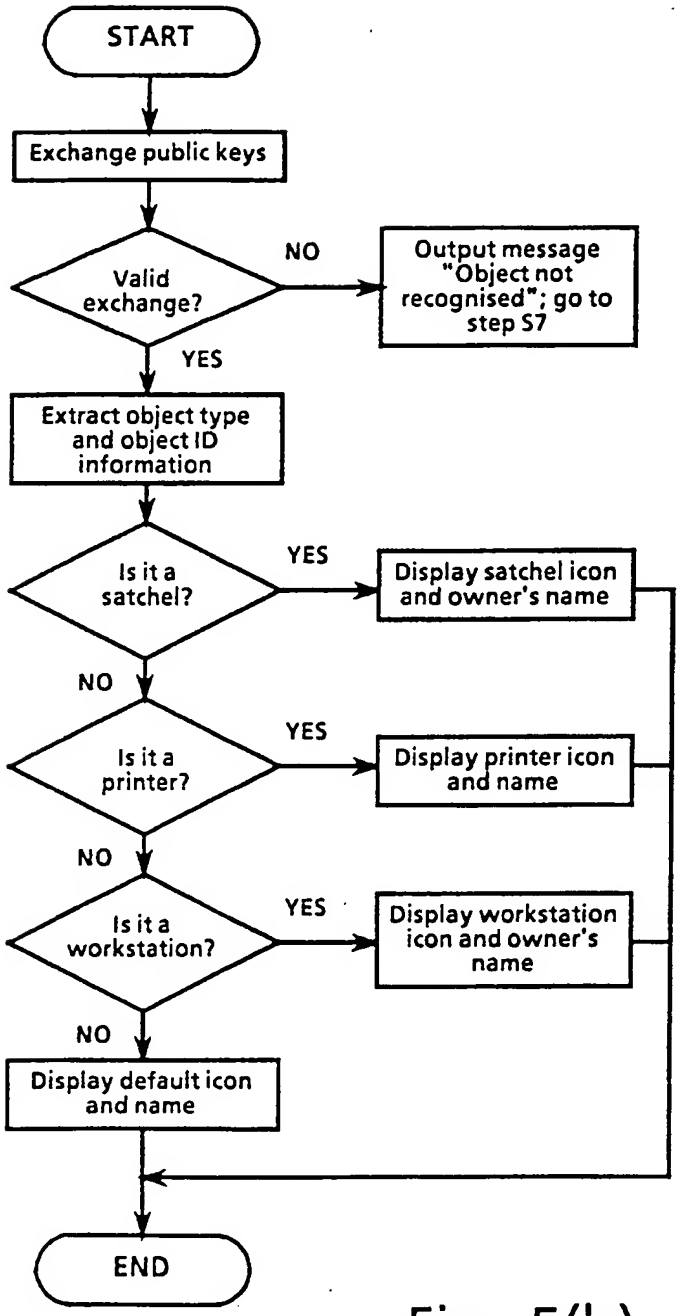

START
Exchange public keys
Valid exchange?
NO
Output message "Object not recognised"; go to step S7
YES
Extract object type and object ID information
Is it a satchel?
YES
Display satchel icon and owner's name
NO
Is it a printer?
YES
Display printer icon and name
NO
Is it a workstation?
YES
Display workstation icon and owner's name
NO
Display default icon and name
END

Fig. 5(b)

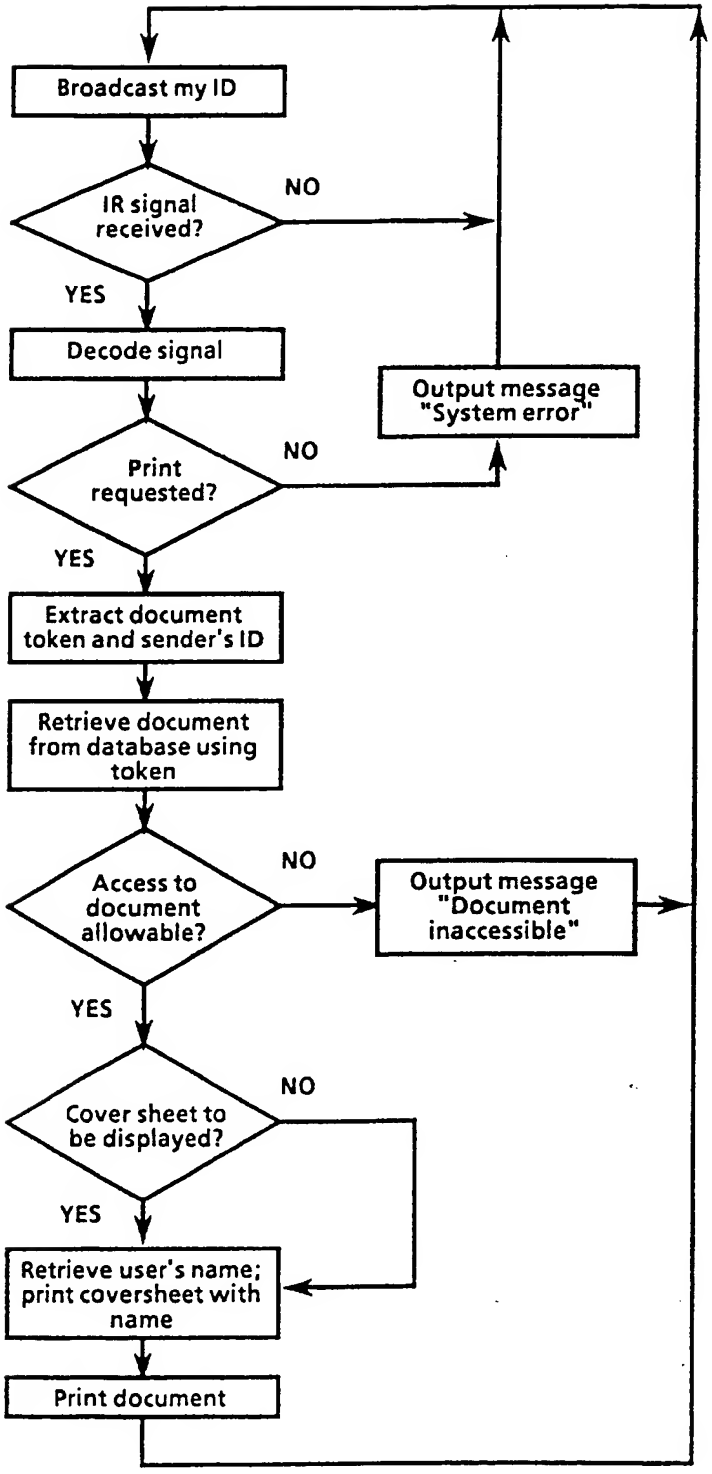

Broadcast my ID
IR signal received?
NO
YES
Decode signal
Output message "System error"
Print requested?
NO
YES
Extract document token and sender's ID
Retrieve document from database using token
Access to document allowable?
NO
Output message "Document inaccessible"
YES
Cover sheet to be displayed?
NO
YES
Retrieve user's name; print coversheet with name
Print document

Fig. 5(c)

Fig.6(a).

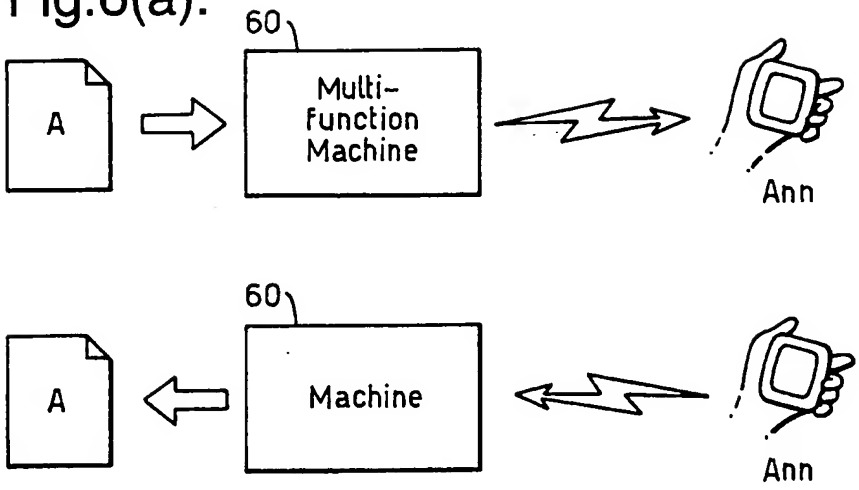


Fig.6(b).

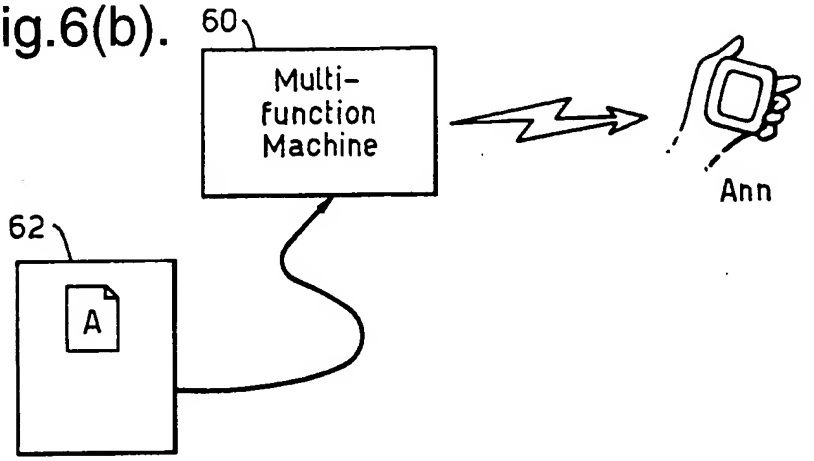


Fig.6(c).

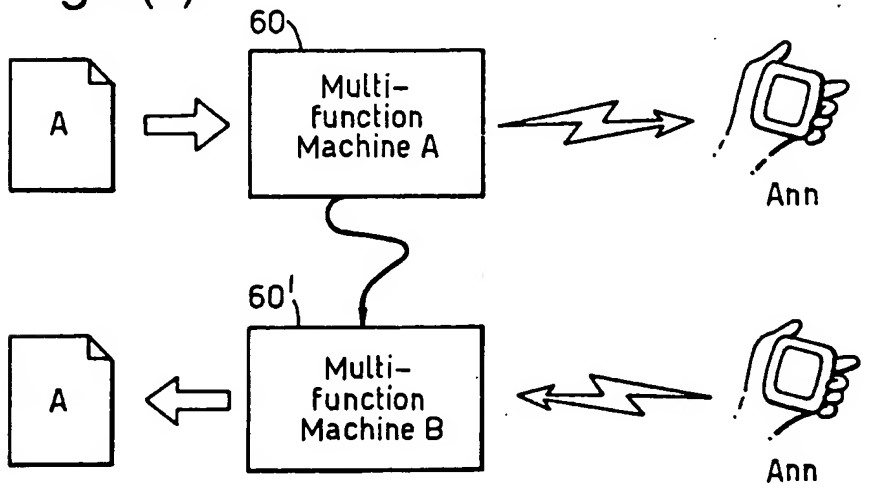


Fig.6(d).

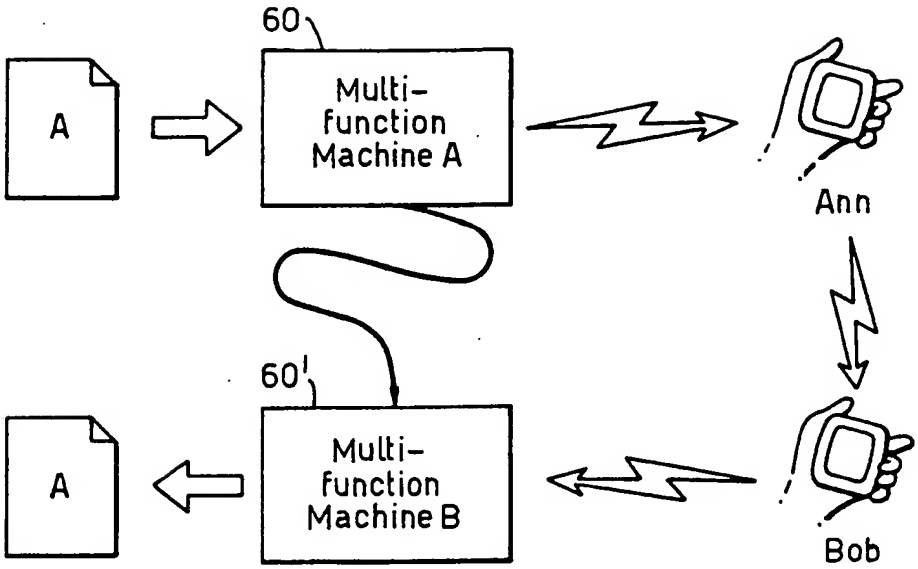

60
A
Multi-
function
Machine A
Ann
60'
A
Multi-
function
Machine B
Bob

Fig.6(e).

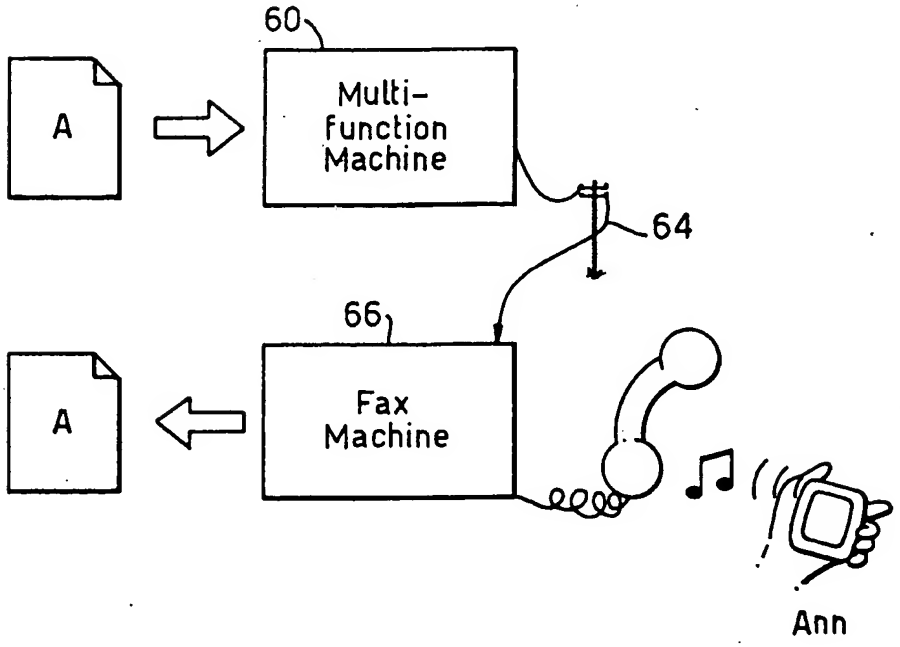

60
A
Multi-
function
Machine
64
66
A
Fax
Machine
Ann

Fig.6(f).

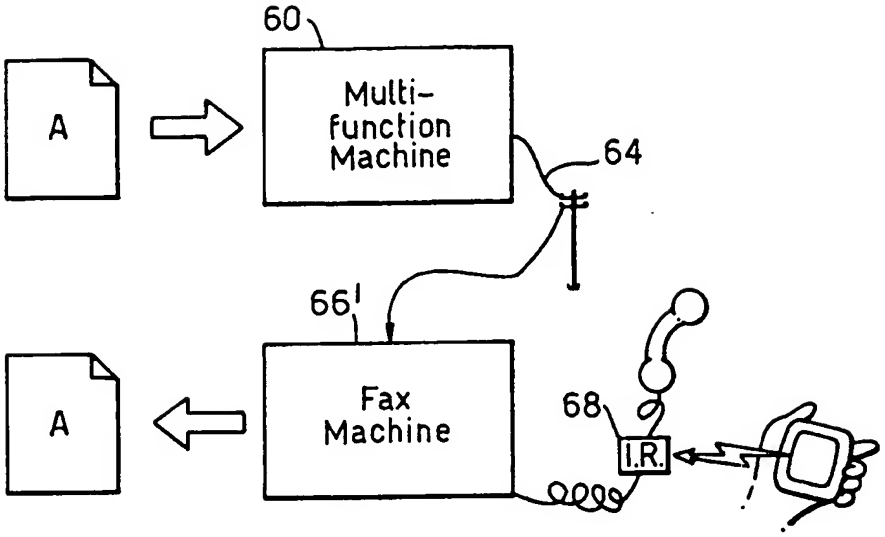
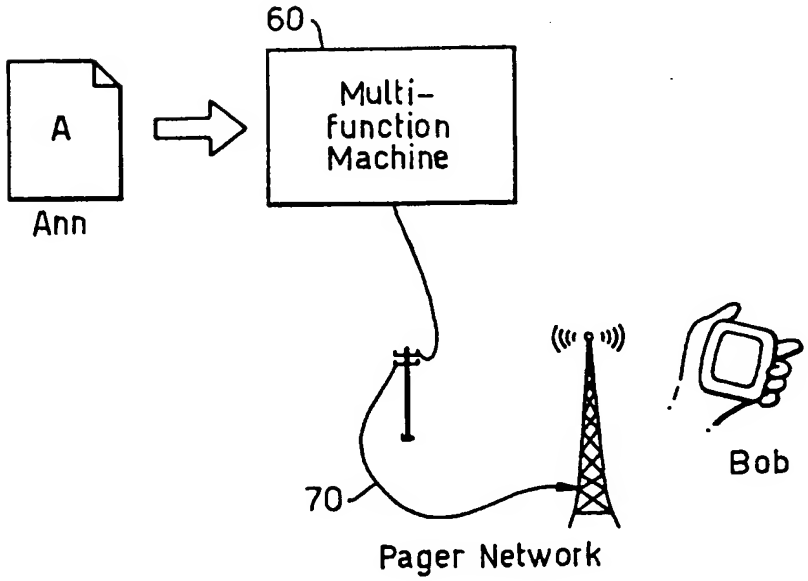

60
Multi-
function
Machine
A
64
66'
Fax
Machine
A
68
I.R.

Fig.6(g).


60
Multi-
function
Machine
A
Ann
70
Pager Network
Bob